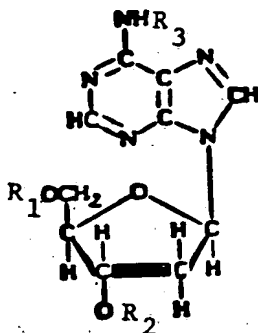


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WHAT IS CLAIMED IS:

1. An acyl derivative of 2'-deoxyadenosine, having the formula



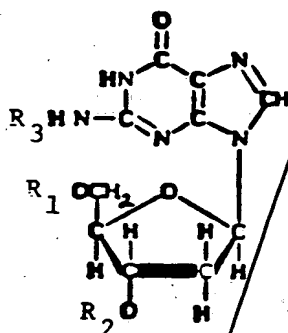
wherein  $R_1$ ,  $R_2$ , and  $R_3$  are the same or different and each is hydrogen or an acyl group derived from

- (a) an unbranched fatty acid with 3 to 22 carbon atoms,
  - (b) an amino acid selected from the group consisting of glycine, the L forms of alanine, valine, leucine, isoleucine, tyrosine, proline, hydroxyproline, serine, threonine, cysteine, aspartic acid, glutamic acid, arginine, lysine, histidine, carnitine, and ornithine,
  - (c) nicotinic acid, or
  - (d) a dicarboxylic acid having 3 to 22 carbon atoms,
- provided that not all of  $R_1$ ,  $R_2$ , and  $R_3$  are H, and where  $R_3$  is not H, then  $R_1$  and/or  $R_2$  may also be acetyl, or a pharmaceutically acceptable salt thereof.

2. An acyl derivative of 2'-deoxyadenosine as recited in claim 1 wherein  $R_1$  is derived from an unbranched fatty acid with 6 to 16 carbon atoms,  $R_2$  is H or derived from an unbranched fatty acid with 6 to 16 carbon atoms, and  $R_3$  is H or derived from an amino acid with an acidic or basic side chain.

3. An acyl derivative of 2'-deoxyguanosine having the formula

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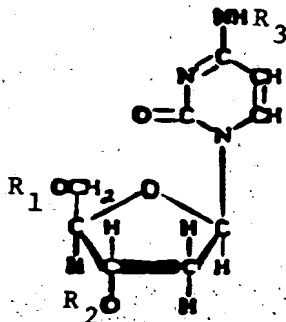
wherein  $R_1$ ,  $R_2$ , and  $R_3$  are the same or different and each is hydrogen or an acyl group derived from

- (a) an unbranched fatty acid with 3 to 22 carbon atoms,
- (b) an amino acid selected from the group consisting of glycine, the L forms of alanine, valine, leucine, isoleucine, tyrosine, proline, hydroxyproline, serine, threonine, cysteine, aspartic acid, glutamic acid, arginine, lysine, histidine, phenylalanine, carnitine, and ornithine,
- (c) nicotinic acid, or
- (d) a dicarboxylic acid having 3 to 22 carbon atoms, provided that not all of  $R_1$ ,  $R_2$ , and  $R_3$  are H, and where  $R_3$  is not H, then  $R_1$  and/or  $R_2$  may also be acetyl, or a pharmaceutically acceptable salt thereof.

4. An acyl derivative of 2'-deoxyguanosine as recited in claim 3 wherein  $R_1$  is an acyl group derived from an unbranched fatty acid with 6 to 16 carbon atoms,  $R_2$  is H or an acyl group derived from an unbranched fatty acid with 6 to 16 carbon atoms or an amino acid with an acidic or basic side chain, and  $R_3$  is H or an acyl group derived from an amino acid with an acidic or basic side chain.

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5. An acyl derivative of 2'-deoxycytidine, having the formula



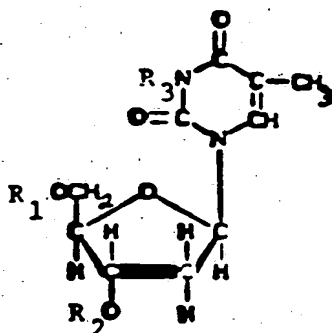
wherein  $R_1$ ,  $R_2$ , and  $R_3$  are the same or different and each is hydrogen or an acyl group derived from

- (a) an unbranched fatty acid with 3 to 22 carbon atoms,
- (b) an amino acid selected from the group consisting of glycine, the L forms of alanine, valine, leucine, isoleucine, tyrosine, proline, hydroxyproline, serine, threonine, cysteine, aspartic acid, glutamic acid, arginine, lysine, histidine, carnitine, and ornithine,
- (c) nicotinic acid, or
- (d) a dicarboxylic acid having 3 to 22 carbon atoms, provided that not all of  $R_1$ ,  $R_2$ , and  $R_3$  are H, and where  $R_3$  is not H, then  $R_1$  and/or  $R_2$  may also be acetyl, or a pharmaceutically acceptable salt thereof.

6. An acyl derivative of 2'-deoxycytidine as recited in claim 5 wherein  $R_1$  is an acyl group derived from an unbranched fatty acid with 6 to 16 carbon atoms,  $R_2$  is H or an acyl group derived from an unbranched fatty acid with 6 to 16 carbon atoms, and  $R_3$  is H or an acyl group derived from an amino acid with an acidic or basic side chain.

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7. An acyl derivative of 2'-deoxythymidine, having the formula

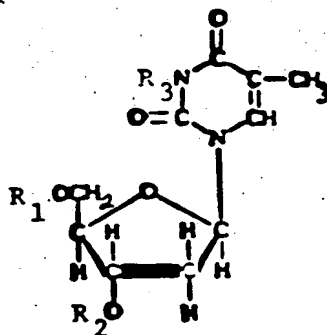


wherein  $R_1$  is an acyl group derived from

- (a) an unbranched fatty acid with 3 to 15 or 17 to 22 carbon atoms,
  - (b) an amino acid selected from the group consisting of glycine, the L forms of alanine, valine, leucine, isoleucine, tyrosine, proline, hydroxyproline, serine, threonine, cysteine, aspartic acid, glutamic acid, arginine, lysine, histidine, carnitine, and ornithine,
  - (c) nicotinic acid, or
  - (d) a dicarboxylic acid having 3 to 22 carbon atoms,
- and  $R_2$  and  $R_3$  are H, or a pharmaceutically acceptable salt thereof.

8. An acyl derivative of 2'-deoxythymidine, as recited in claim 7 wherein  $R_1$  is an acyl group derived from an unbranched fatty acid with 6 to 15 carbon atoms.

9. An acyl derivative of 2'-deoxythymidine, having the formula



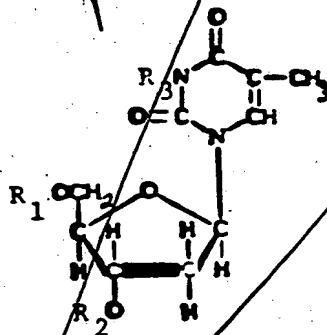
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wherein  $R_1$  is H,  $R_2$  is an acyl group derived from

- (a) an unbranched fatty acid with 3 to 13 or 15 to 22 carbon atoms,
  - (b) an amino acid selected from the group consisting of glycine, the L forms of alanine, valine, leucine, isoleucine, tyrosine, proline, hydroxyproline, serine, threonine, cysteine, aspartic acid, glutamic acid, arginine, lysine, histidine, carnitine, and ornithine,
  - (c) nicotinic acid, or
  - (d) a dicarboxylic acid with 3 to 22 carbon atoms,
- and  $R_3$  is H or a pharmaceutically acceptable salt thereof.

10. An acyl derivative of 2'-deoxythymidine as recited in claim 9, wherein  $R_2$  is an acyl group derived from an unbranched fatty acid with 16 carbon atoms.

11. An acyl derivative of 2'-deoxythymidine, having the formula



wherein  $R_1$  and  $R_2$  are the same or different and each is an acyl group derived from

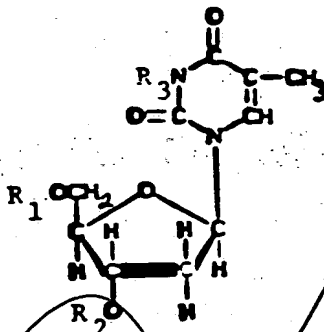
- (a) an unbranched fatty acid with 5 to 22 carbon atoms,
- (b) an amino acid selected from the group consisting of glycine, the L forms of alanine, valine, leucine, isoleucine, tyrosine, proline, hydroxyproline, serine, threonine, cysteine, aspartic acid, glutamic acid, arginine, lysine, histidine, carnitine, and ornithine,
- (c) nicotinic acid, or
- (d) a dicarboxylic acid with 3 to 22 carbon atoms,

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and  $R_3$  is H or a pharmaceutically acceptable salt thereof.

12. An acyl derivative of 2'-deoxythymidine as recited in claim 11 wherein  $R_1$  and  $R_2$  are the same or different and each is an acyl group derived from an unbranched fatty acid with 6 to 16 carbon atoms.

13. ✓ An acyl derivative of 2'-deoxythymidine, having the formula



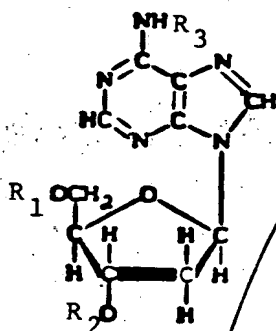
wherein  $R_1$  and  $R_2$  are the same or different and each is an acyl group derived from

- (a) an unbranched fatty acid with 2 to 22 carbon atoms,
  - (b) an amino acid selected from the group consisting of glycine, the L forms of alanine, valine, leucine, isoleucine, tyrosine, proline, hydroxyproline, serine, threonine, cysteine, aspartic acid, glutamic acid, arginine, lysine, histidine, carnitine, and ornithine,
  - (c) nicotinic acid, or
  - (d) a dicarboxylic acid with 3 to 22 carbon atoms,
- and  $R_3$  is an acyl group derived from an optionally substituted benzoyl or heterocyclic carboxylic acid that is substantially nontoxic, or a pharmaceutically acceptable salt thereof.

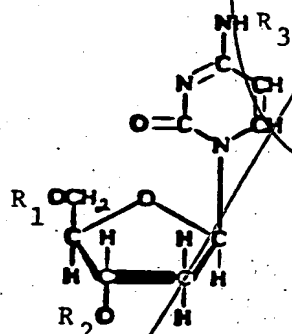
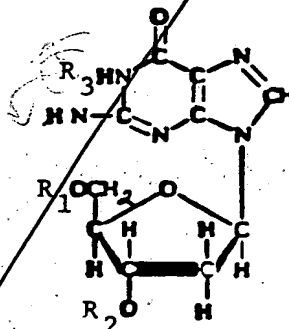
14. An acyl derivative of 2'-deoxythymidine, as recited in claim 13 wherein  $R_1$  and  $R_2$  are the same or different and each is an acyl group derived from an unbranched fatty acid with 6 to 16 carbon atoms and  $R_3$  is an acyl group derived from nicotinic acid, benzoic acid, or para-aminobenzoic acid.

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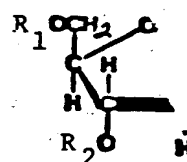
15. A pharmaceutical composition comprising an effective amount of each of at least two compounds selected from at least two of the groups of compounds having the formulae:



(I)



(III)



(IV)

new

wherein  $R_1$ ,  $R_2$ , and  $R_3$  are the same or different and each is H or an acyl group derived from a carboxylic acid, provided that at least one of said substituents  $R_1$ ,  $R_2$ , and  $R_3$  on each of said groups of compounds is not hydrogen, or pharmaceutically acceptable salts thereof.

16. A composition as recited in claim 15 wherein  $R_1$ ,  $R_2$ , and  $R_3$  are the same or different and each is H or an acyl group derived from a carboxylic acid selected from the group consisting of an amino acid, an unbranched fatty acid containing 2 to 22 carbon atoms, a dicarboxylic acid containing 3 to 22 carbon atoms, and an optionally substituted benzoyl or heterocyclic aromatic carboxylic acid that is substantially nontoxic.

17. The composition of claim 16, wherein said amino acid is selected from the group consisting of glycine, the L forms of alanine, valine, leucine, isoleucine, phenylalanine, tyrosine, proline, hydroxyproline, serine, threonine, cysteine, cystine, methionine, tryptophan, aspartic acid, glutamic acid, arginine, lysine, histidine, ornithine, carnitine, and hydroxylysine.

18. A composition as recited in claim 15 which further includes at least one compound from said groups of compounds wherein  $R_1$ ,  $R_2$ , and  $R_3$  are all hydrogen.

19. A composition as recited in claim 15, which comprises an effective amount of at least three compounds selected from at least three of said groups of compounds.

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20. A composition as recited in claim 15 which comprises an effective amount of at least four compounds selected from at least four of said groups of compounds.

21. The composition of claim 15, further comprising at least one of the radioprotective compounds selected from the group consisting of: WR-2721, NAC, DDC, cysteamine, 2-mercaptoethanol, mercaptoethylamine dithiothreitol, glutathione, 2-mercaptoethanesulfonic acid, WR-1065, nicotinamide, 5-hydroxytryptamine, 2-beta-aminoethyl-isothiuronium-Br-Hbr, glucans, GLP/B04, GLP/B05, OK-432, Biostim, PSK, Lentinan, Schizophyllan, Rhodexman, Levan, Mannozy, MVE-2, MNR, MMZ, IL-1, TNF, thymic factor TF-5, glutathione peroxidase, superoxide dismutase, catalase, glutathione reductase, glutathione transferase, selenium,  $\text{CdCl}_2$ ,  $\text{MnCl}_2$ , Zn acetate, Vitamin A, beta carotene, prostaglandins, tocopherol, methylene blue and PABA.

a 22. A composition comprising one or more compounds as recited in claim 1, ~~3, 5, 7, 9, 11, or 13~~ and a pharmaceutically acceptable carrier.

23. A composition as recited in claim 15 further comprising a pharmaceutically acceptable carrier.

a 24. A composition comprising one or more compounds as recited in claims ~~22 or 23~~, further comprising at least one radioprotective compound selected from the group consisting of WR-2721, NAC, DDC, cysteamine, 2-mercaptoethanol, mercaptoethylamine dithiothreitol, glutathione, 2-mercaptoethanesulfonic acid, WR-1065, nicotinamide, 5-hydroxytryptamine, 2-beta-aminoethyl-isothiuronium-Br-Hbr, glucans, GLP/B04, GLP/B05, OK-432, Biostim, PSK, Lentinan, Schizophyllan, Rhodexman, Levan, Mannozy, MVE-2, MNR, MMZ, IL-1, TNF, thymic factor TF-5, glutathione peroxidase, superoxide dismutase, catalase, glutathione reductase, glutathione transferase, selenium,  $\text{CdCl}_2$ ,  $\text{MnCl}_2$ , Zn acetate, Vitamin A, beta carotene, prostaglandins, tocopherol, methylene blue and PABA, and a pharmaceutically acceptable carrier.

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a  
a 25. A composition as recited in claim 22, ~~23, or 24~~ in the form of a liquid, a suspension, a tablet, a dragee, an injectable solution, a topical solution, or a suppository.

a 26. A composition as recited in claim 22 ~~or 23~~, comprising: 0-50 mole percent of an acyl derivative of 2'-deoxycytidine, 0-50 mole percent of an acyl derivative of 2'-deoxyguanosine, 0-50 mole percent of an acyl derivative of 2'-deoxythymidine, and 0-50 mole percent of an acyl derivative of 2'-deoxyadenosine, the total content of acyl deoxyribonucleosides adding up to 100 mole percent.

27. A composition as recited in claim 26, comprising 25 mole percent of each of the said acyl deoxyribonucleosides.

a 28. A skin lotion containing an effective amount of a composition as recited in claims 22 ~~or 23~~.

29. The skin lotion of claim 28, wherein said composition is present in from 0.1-5% by weight.

a  
a 30. A bioerodible microcapsule containing an effective amount of a composition as recited in claims 22 ~~or 23~~.

31. The composition as recited in claim 30, wherein said bioerodible microcapsules comprise a polymer selected from the group consisting of polylactate and a lactate-glycolate copolymer.

a  
a 32. A method of enhancing the delivery of exogenous deoxyribonucleosides to the tissue of an animal, comprising the step of administering to said animal an effective amount of an acyl derivative of a deoxyribonucleoside as recited in claims 1, ~~2, 5, 7, 9, 11, or 13~~.

33. A method of treating physiological or pathological conditions of the tissue of an animal by supporting the metabolic function thereof, comprising increasing the bioavailability of deoxyribonucleosides to said tissue by administering to said animal an effective

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a amount of an acyl derivative of a deoxyribonucleoside as recited in claims 1, ~~3, 5, 7, 9, 11, or 13.~~

a 34. A method for treating or preventing radiation-induced cellular damage comprising administering to an animal an effective amount of a composition as recited in claim 22 ~~or 23.~~

a 35. A method for treating or preventing sunlight-induced cellular damage comprising administering to an animal the composition of claim 22 ~~or 23.~~

36. A method for treating or preventing radiation or sunlight-induced cellular damage comprising administering to an animal an effective amount of a skin lotion as recited in claim 28.

a 37. A method for treating or preventing mutagen-induced cellular damage comprising administering to an animal an effective amount of a composition as recited in claim 22 ~~or 23.~~

a 38. A method for enhancing the healing of damaged tissue comprising administering to an animal an effective amount of a composition as recited in claim 22 ~~or 23.~~

39. The method of claim 38, wherein said damaged tissue comprises skin wounds.

40. The method of claim 38, wherein said damaged tissue comprises burned tissue.

41. The method of claim 38, wherein said damaged tissue comprises diseased or damaged liver tissue.

42. The method of claim 38, wherein said damaged tissue comprises heart muscle damaged as a result of myocardial infarction.

43. The method of claim 38, wherein said damaged tissue is bone marrow.

44. The method of claim 38, wherein said method enhances hematopoiesis.

45. A method for enhancing the transport of deoxyribonucleosides across the gastrointestinal tract and thereby enhancing the bioavailability of said deoxyribonucleosides, comprising administration to an animal

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of an effective amount of an acyl derivative of a deoxyribonucleoside as recited in claims 1, ~~2, 3, 5, 7, 9, 11, or 13.~~

46. A method for enhancing the transport of 2'-deoxycytidine, 2'-deoxyguanosine, 2'-deoxyadenosine, and 2'-deoxythymidine across the gastrointestinal tract and thereby enhancing the bioavailability of said deoxyribonucleosides, comprising administration to an animal of an effective amount of a composition as recited in claim 15.

add  
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